

REMARKS

Claims 14-16, 18-25, 33-40, and 42-43 remain pending in this application.

Claims 14, 25, and 43 have been amended, as shown in the foregoing listing of claims.

The Examiner rejected claim 14 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The Examiner asserts that the terminology “initially predominantly coating the fibers of that fibrous structure preform with elemental carbon to impregnate that preform with elemental carbon” is unclear as to whether a coating step or an impregnating step or both is occurring. The Examiner states that “[c]oating is not considered equivalent to impregnating.”

Applicants agree that “[c]oating is not considered equivalent to impregnating,” but the Examiner misunderstands the use of the terms “coating” and “impregnating” in the claim. Claim 14 does not use the terms “coating” and “impregnating” as equivalents. Rather, claim 14 clearly indicates that the preform is “impregnated” with elemental carbon by “coating” the fibers of the preform. Because the carbon-coated fibers extend in spaced positions and orientations throughout the volume of the preform, the carbon also impregnates the preform (i.e., projects into the interior of the preform). Therefore, claim 14 sets forth in sufficient detail the manner of coating and impregnation with the elemental carbon. The § 112 rejection of claim 14 should be withdrawn.

The Examiner rejected claims 14-16, 18-25, 33-40, 42 and 43 under 35 U.S.C. § 102(a or e) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over Gruber et al (6,537,654). The Examiner acknowledges that Gruber fails to disclose the grain size of the silicon carbide, but contends that the burden is upon Applicants to

show that Gruber does not have the characteristics of Applicants' claimed invention. Applicants provide such a showing below.

One of the steps recited in claim 14 requires the preform to be infiltrated with a ceramic slurry (such as boron carbide) to predominantly impregnate the fibers of the preform. The Examiner asserts that Gruber teaches the addition of boron carbide to the disclosed material and cites column 12, lines 7-25. The Examiner's citation refers to a portion of the Gruber patent indicating that boron carbide may be used as a filler. Gruber does not teach or suggest the use of boron carbide or other ceramic slurry to impregnate a preform as required by Applicants' claims. The physical structure disclosed in Gruber, resulting from the incorporation of boron carbide as a filler, is substantially different than the physical structure of Applicants' claimed invention, resulting from the incorporation of that same material as an infiltrant. The addition of a filler to a product typically results in a product that is bulkier, heavier, stronger, or more viscous than it would be without the filler. See, e.g. MERRIAM-WEBSTER'S COLLEGIATE DICTIONARY, 11th ed. (2003), p.468 (defining "filler" as "a substance added to a product (as to increase bulk, weight, viscosity, opacity, or strength)"); see also www.merriamwebster.com (same definition). In contrast, as explained in Applicants' specification, the use of a ceramic slurry, such as boron carbide, as an infiltrant in Applicants' claimed invention results in a material with a structure that permits interaction of the boron carbide with the infiltrated carbon and silicon to regulate the reaction of silicon and carbon to form silicon carbide, thereby preventing large grain growth and resulting in the desired microstructure. See, e.g., Applicants' specification, paragraphs [0055]-[0056]. Moreover, Gruber teaches away from including a ceramic

material such as boron carbide as an infiltrant because its use as an infiltrant would create a boron carbide phase and defeat Gruber's stated objective of producing a "matrix [that] contains *only* phases of silicon carbide, silicon and carbon." Gruber, col. 6, lns. 52-56 (emphasis added).

Gruber fails to disclose a structure similar to that of the claimed invention for yet another reason. Gruber suggests adding silicon carbide to the disclosed material. See Gruber, col. 12, lns. 7-12. As explained in paragraph [0052] of Applicants' specification, added silicon carbide particles serve as "seeds" for silicon carbide grain growth, resulting in a material with large silicon carbide particles. See also Vijay Vasant Pujar, *Processing and Microstructural Characterization of Reaction-Formed Silicon Carbide (RFSC) and Computer Simulations, X-Ray Diffraction and High Resolution Transmission Electron Microscopy of Stacking Faults in β -SiC*, Case Western Reserve University Dissertation, January 1997, pp.48-50 (cited in Supplemental Information Disclosure Statement submitted with this Response). In contrast, Applicants' claims require a fibrous structure that is impregnated with a ceramic slurry such as boron carbide, resulting in the formation of small silicon carbide particles. Thus, Gruber does not teach or suggest the structure claimed by Applicants. As a result, the § 102/103 rejection based on Gruber should be withdrawn.

The Examiner rejected claims 25, 33-40, 42 and 43 under 35 U.S.C. § 102(a) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over Japanese document 200256064. The Examiner acknowledges that the Japanese document fails to disclose the grain size of the silicon carbide, but contends that the burden is upon Applicants to show that the Japanese document does not have the characteristics of

Applicants' claimed invention. Applicants provide such a showing below. The Examiner also acknowledges that the Japanese document fails to disclose coating the fibers with elemental carbon, but notes that claims 25, 33-40, 42 and 43 do not require that the fibers be coated with elemental carbon.


Applicants have amended independent claims 25 and 43 to require that the fibers be coated with elemental carbon. As acknowledged by the Examiner, the Japanese document does not disclose such a coating. It would not have been obvious to one of ordinary skill in the art to modify the material disclosed in the Japanese document to take a fibrous structure comprising carbon, polyacrylonitrile, or rayon fiber and coat those fibers with elemental carbon. Indeed, coating a carbon-based fiber with additional carbon is counterintuitive, especially in view of the fact that coating a carbon-based fiber with additional carbon and then forming a silicon carbide/silicon matrix by melt infiltration typically results in the silicon phase reacting with the carbon coating and the carbon fiber, resulting in a composite with different physical properties. See page 10, paragraph [0045] of Applicants' specification (noting the importance to the physical properties of the composite of avoiding a reaction between the silicon matrix and the underlying fibrous structure); and page 15, paragraph [0064] (emphasizing that a reaction between the silicon and the CVD carbon and carbon fibers is undesirable and should be prevented). Therefore, the cited reference does not teach or suggest the claimed invention.

Moreover, the Japanese document does not teach or suggest a fibrous structure that is subsequently predominately impregnated with boron carbide or that has a silicon carbide phase in which the silicon carbide grain size is less than about 10 microns, as

required by Applicants' claims. Instead, the Japanese document teaches mixing the boron carbide with the silicon carbide and suggests that these materials need not be impregnated into the structure. See paragraphs [0012] and [0013] of Japanese document translation. As explained in paragraph [0052] of Applicants' specification, when silicon carbide particles are mixed with boron carbide particles, the silicon carbide particles serve as "seeds" for silicon carbide grain growth, resulting in a material with large silicon carbide particles. In contrast, Applicants' claims require a fibrous structure that is initially impregnated with elemental carbon and then subsequently impregnated with boron carbide, resulting in a material with a silicon carbide phase having silicon carbide particles with a grain size of less than about 10 microns. Therefore, the Japanese document does not teach or suggest Applicants' claimed invention. As a result, the § 102/103 rejection based on the Japanese document should be withdrawn.

Applicants respectfully request that the Examiner's rejections be withdrawn and the application deemed in condition for allowance. If, for any reason, the Examiner feels that the above amendments and remarks do not put the claims in condition for allowance, he is requested to contact the undersigned attorney at (312) 222-8105 to resolve any remaining issues.

Respectfully submitted,


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